**ResMed Software Support**

**Hours** 5:30 AM to 5:30 PM (Pacific Time) Monday–Friday

**Phone** +1 (800) 424-0737, Option 6

**Email** TechSupportUSA@resmed.com
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Purpose of This Guide

The purpose of this guide is to demonstrate how to read and interpret treatment data with ResScan™, using examples of patients treated on S9™ devices.

ResScan gives access to several different levels of information about the patient’s therapy. According to preference, you can view this information in ResScan (see example below) or in a PDF report (examples shown on the following pages).
Help is Available

The Help button can be found on the top of top tool bar. The Help button provides access to:

- Contact Us,
- ResMed.com website
- Comprehensive content library.

Users can search by keyword or alphabetically within the index.

Users can also contact Software Support directly.

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Email
TechSupportUSA@resmed.com
Getting Started with ResScan
Gettting Started

Copy Data from PAP Device

1. Insert card (if not already in device)

2. The following message is briefly displayed “Reading SD card”

3. Remove card

4. Transfer data on card to software program
Types of Available Data

Summary Data
- Usage
- Efficacy (eg, AHI, pressure, leak)

Detailed Data
- Nightly profile data

High Resolution Data
- Higher data sampling rate
- Flow data: Overall airflow breath by breath

Oximetry Data (available with S9 Oximeter modules)
- Oxygen desaturation index (ODI)
- Blood oxygen saturation (SpO₂)
- Pulse rate

ResMed devices offer various types of data to monitor patients’ usage and therapy efficacy. The types of data available vary with device platforms, device models and acquisition accessories used.

Value-end devices provide essential patient usage information such as daily summary data. Premium devices such as AutoSet™ and Elite™ support additional data capabilities.
# Data Types Available by Device

## Data Storage

<table>
<thead>
<tr>
<th>S9 Series</th>
<th>Escape / Escape Auto</th>
<th>Elite</th>
<th>AutoSet</th>
<th>VPAP Auto</th>
<th>VPAP S</th>
<th>VPAP ST</th>
<th>VPAP Adapt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep report on screen (365 sessions)</td>
<td>·</td>
<td>·</td>
<td>·</td>
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<td></td>
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<tr>
<td>Compliance and summary data on device (365 sessions)</td>
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</tr>
<tr>
<td>Compliance and summary data on SD card (365 sessions)</td>
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<tr>
<td>Detailed data on SD card (30 sessions)</td>
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<td>·</td>
<td></td>
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<tr>
<td>High resolution flow data on SD card (7 sessions)</td>
<td></td>
<td>·</td>
<td>·</td>
<td>·</td>
<td>·</td>
<td>·</td>
<td></td>
</tr>
<tr>
<td>High resolution pressure data on SD card (7 sessions)</td>
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<td></td>
</tr>
</tbody>
</table>

## ResScan Display

<table>
<thead>
<tr>
<th>S9 Series</th>
<th>Escape / Escape Auto</th>
<th>Elite</th>
<th>AutoSet</th>
<th>VPAP Auto</th>
<th>VPAP S</th>
<th>VPAP ST</th>
<th>VPAP Adapt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistics</td>
<td></td>
<td>·</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary Graphs</td>
<td></td>
<td>·</td>
<td>·</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detailed Graphs</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oximetry Statistics*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oximetry Graphs*</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Only available when the S9 oximeter module is used with device.
Launch ResScan

Install the program from your browser or CD, then launch the program from the newly created desktop shortcut or from Programs.

Contact Software Support to receive proper installation instructions.

Software Support

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Email
TechSupportUSA@resmed.com
Data Card Download Option 1—Quick Start Enabled

Create/open patient record
Data Card Download Option 2—Quick Start Disabled

Create/open patient record

New patient + Download data

OR

Open patient
Create New Patient Record

Select **New patient** from the ResScan home page.

Fill in required information and click **Save**.
Open a Patient Record

Select **Open patient** from the ResScan home page to open a patient file.

Highlight the patient’s name and click **Open**.
Download Data—Select Data Type

To begin downloading with the following details, simply press the Start Download button.

Patient: 59 Patient, Test
Device: 59 Autoset on SD card / USB flash disk on Drive F:
Data: All available data

Typical Download Times:
- Summary Data (90 Sessions): 0 mins 10 secs
- Detailed Data (1 Session): 0 mins 15 secs

Start Download
Download Options

Select Data Type to Download

Select the data type to retrieve from the selected device.

- All Summary data only
- All Summary data and...
  - Include equivalent number of high rate data sessions (if available)
  
  (This requires more storage space on the PC and extends download times.)

Note, data types vary from different devices and selected types are not always available.

Set these as my default options

OK Cancel
Download Data—Start Download

To begin downloading with the following details, simply press the Start Download button.

**Patient:** 59 Patient, Test

**Device:** 59 Autoset on SD card / USB flash disk on Drive F:

**Data:** All available data

**Typical Download Times**
- Summary Data (90 Sessions): 0 mins 10 secs
- Detailed Data (1 Sessions): 0 mins 15 secs

[Start Download] [Close]
When the download is complete, click the Close button. The data will now appear on the left side of the Review window.
ResScan

First 30 Days Compliance Reporting

• Software automatically identifies first 30-day date range when patient meets Medicare compliance criteria*

CMS reimbursement guideline

• Use of PAP ≥ 4 hours per night
• 70% of nights during a consecutive 30-day period anytime during the first three months of initial usage

*Medicare adherence to therapy is defined as use of PAP ≥ 4 hours per night on 70% of nights during a consecutive 30-day period anytime during the first three months of initial usage. - CMS, LCD for PAP Devices for the Treatment of OSA, Jurisdiction A, B, C, D, updated April 1, 2010
When First 30 Days is chosen, software will automatically select the first 30 days of compliance per Medicare guidelines.
## First 30 Days Statistics

### Usage

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total hours used (hrs:min)</td>
<td>198:08</td>
</tr>
<tr>
<td>Median daily usage (hrs/day of used days)</td>
<td>7:42</td>
</tr>
<tr>
<td>Average daily usage (total hrs/total days)</td>
<td>6:36</td>
</tr>
<tr>
<td>Used Days &gt;= 4 hrs</td>
<td>25 days</td>
</tr>
<tr>
<td>Used Days &lt; 4 hrs</td>
<td>3 days</td>
</tr>
<tr>
<td>Days not used</td>
<td>2 days</td>
</tr>
<tr>
<td>Total days</td>
<td>30 days</td>
</tr>
<tr>
<td>% Used Days &gt;= 4 hrs</td>
<td>83%</td>
</tr>
</tbody>
</table>

### Leak

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>0.0</td>
</tr>
<tr>
<td>95th Percentile</td>
<td>13.2</td>
</tr>
<tr>
<td>Maximum</td>
<td>24.0</td>
</tr>
</tbody>
</table>

### AHI & AI

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apnea index</td>
<td>1.1</td>
</tr>
<tr>
<td>Hypopnea index</td>
<td>6.3</td>
</tr>
<tr>
<td>AHI</td>
<td>7.3</td>
</tr>
<tr>
<td>% Time in Apnea</td>
<td>0.3</td>
</tr>
</tbody>
</table>
Compliance Report Ready to Print

First 30 Days Report

Patient Profile

Patient Information
Patient Name: [Name]
Patient ID: [ID]
Date of Birth: [Date]
Gender: [Gender]
Age: [Age]

Statistics
Serial No.: 22101432813
Product: S9 AutoSet

7/3/2010 - 8/1/2010

Device Settings
Therapy Mode: AutoSet
Minimum Pressure: 4.0 cmH2O
Maximum Pressure: 20.0 cmH2O

EPR Level: 2.0 cmH2O

[Legend: Summary Data]
Sample First 30 Days Report

First 30 Days Report

Patient Profile

Patient Information
- Patient Name: Mr Compliant Patient
- Patient ID: 01011950
- Date of Birth: 1 January 1950
- Gender: Male

Age: 61

Statistics
- Serial No.: 22091401022
- Product: S9 AutoSet


Device Settings
- Therapy Mode: AutoSet
- EPR Level: 2.0 cmH2O
- Minimum Pressure: 4.0 cmH2O
- Maximum Pressure: 20.0 cmH2O

Usage
- Used Days >= 4 hrs: 28
- Days not used: 1
- Total hours used: 100:36

CMS Compliance
- Compliance: 93.3%
- CMS Compliant: Yes

Consecutive 30-day period when compliance was achieved.

Overall compliance percentage and compliance criteria met.
Compliance Not Met

Software will display warning message

![Warning Message]

Compliance criteria not met.
Noncompliant Patient

The Usage Compliance report is shown when patient does not meet compliance criteria.
There are several report templates automatically installed with the ResScan software. Users are able to customize these default templates, as well as create a new report template.

The default report templates are:
- All Available Data
- Detailed Data
- First 30 Days Report
- Statistical Data
- Summary Data
- Usage Compliance Report
Customize Existing or Create New Template

Click **New** to create a new report template

Or select an existing report template to modify

Tabs represent sections of the template to customize

Fields within each section to select

Create individual custom report templates for each referral source
Customize Report Template

Highlight field to **Add** to a section

Highlight field to **Remove** a section
Customize Report Template

Move section or field order within the report

Uncheck box to remove page break in the report (reduces number of pages in report)
Customize Report Template

- Delete a report template
- Save the changes to the report template
Customize Report Template

Will be prompted to save or discard any changes made to the template.

Can create report templates for physicians and referral sources.
ResScan Interpretation

Provides clinical data analysis information to users
Statistical Data: Therapy Overview

This is an example from a ResScan statistics report. The same type of data is presented in ResScan.

The numbers 1–4 on the left show the recommended order in which the data should be analyzed.

**DEFINITIONS**

- **Leak**: This refers to unintentional leak, which is the leak value after deduction of the intentional mask leak.
- **Maximum Value**: The highest value reached during treatment.
- **95th percentile value**: The value exceeded during the selected range for 5% of the time. This value excludes very high leak values which are not always representative of actual clinical experience.
- **Median Value**: The median value recorded during the selected range. This value minimizes the impact of extreme values and is a better representation of the group of values as a whole.
- **AHI, AI, CAI, OAI, HI**: Number of events per hour according to the event type
  - **OAI**: Obstructive apnea index (upper airway closed)
  - **CAI**: Central apnea index (upper airway open)
  - **Unknown AI**: Index of undetermined apneas with large unintentional leaks > 0.5 L/s (30 L/min).
Summary data: How the Therapy Changed During the Time Period

This is an example from a ResScan summary report.

**Daily therapy usage with therapy start and end times and pauses in therapy**

**Unintentional leak**
- Critical leak threshold $> 24 \text{L/min or } 0.4 \text{L/s}$

**Hypopnea index and apnea index**

**Pressure**

**DEFINITIONS**

**Usage:** Allows you to assess patient compliance and identify irregular usage.

**Pressure:** Allows you to identify variations in pressure during the night, or from one night to the next.

**Unintentional leak:** The leak is abnormally high if the 95th percentile is $> 24 \text{L/min}$ and/or the median leak is high.

**AHI, AI:** Including the total apnea index (AI – in red) and hypopnea index (HI – in white).
Select Detailed Graphs

Click to load detailed data.

12/12/2009
Detailed Graphs—Split Screen

Available with Elite, AutoSet and bilevel therapy devices
Detailed Graphing Options—Select Traces

Specify number of graphs to display

Select type of graph to view
Detailed Graphing Options—Time Period

Select time period in order to hone in on specific events.

Notice same period of therapy in different scale.
Detailed Data Graphs

**Therapy pressure**
Pressure settings indicated by red threshold lines

**Unintentional leak**
Leak threshold setting indicated by red line

**Events**
Type of event (e.g., central apnea) and duration of event in seconds (number at top of event line)

**AHI per hour**
 Resets each hour
Detailed Data—Leak

Single night
- Looking for leak to be below 24 L/min over the course of the night
- High leak may be affecting the accuracy of the data

Periods of leak > 24 L/min during the night
Detailed Data—Pressure

Pressure

- Review pressure increases in response to events
- Once the airway remains patent, the pressure begins to drop
Detailed Data—Obstructive Apnea

Obstructive apnea event (13 seconds)

CSA Detector begins 4 seconds into apnea: FOT determines if airway is open or closed

CSA Detector determines airway is closed

13 second apnea

Increase in pressure
Detailed Data—Central Apnea

Central apnea event (29 seconds)

CSA Detector begins 4 seconds into apnea:
FOT determines if airway is open or closed

CSA Detector determines airway is open

No pressure change

29 second apnea
Detailed Data for a Single Night: To Get to the Heart of the Therapy

Detailed data is available on the past 30 days: Leak, event types, flow limitation, snore index, events, pressure and minute ventilation, as well as SpO2 and pulse rate.

In the inspiratory Flow Limitation graph, the taller the bar, the more severe the limitation.

In the Snore Index graph, the taller the bar, the more severe the snore.

The event types (obstructive/central/unknown apneas and hypopneas) are shown in the key beside the Events graph. The duration of the apneas are indicated on the event bar.

Note: The user can configure the layout of the graphs when selecting a report.
High Resolution Data for a Single Night: Flow Curve

The patient’s flow curve is available for the last 7 days. Here are some examples of flow curves in relation to respiratory events.

On this screen, the upper and lower windows are displayed with 2 different time scales (customizable).

In the this example, the circles indicate time scales of 5 hours (upper window) and 1 minute (lower window respectively.)
High Resolution Data for a Single Night: Flow Curve

The events are color-coded according to type.

**Central Apnea:**
Apnea with an open airway

**Obstructive Apnea:**
Apnea with a closed airway

**Unknown Apnea:**
Apnea that cannot be defined because it occurs in the presence of high unintentional leak (> 0.5 L/s or 30 L/min)

**Hypopnea:**
Hypopnea associated with flow limitation

The number above the event indicates apnea duration in seconds

Flow curves are available if downloaded by selecting the “Include equivalent number of high rate data sessions” check box.

You can make this your default option.
Oximetry
Oximetry Data

- Available with oximeter modules
- Downloaded with Detailed Data
- Beneficial to use for very difficult-to-treat patients in evaluating the efficacy of their therapy
- SpO₂: Arterial oxygen saturation
- ODI: Oxygen desaturation index
  - Number of desaturation events/hour
  - Desaturation event triggered when SpO₂ drops below threshold (default ≥ 4 %)

<table>
<thead>
<tr>
<th>ODI Detection Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpO₂ decline threshold</td>
</tr>
</tbody>
</table>

- Pulse rate: Heart rate per minute
Detailed Data Graphs—Oximetry

Correlate events, therapy and desaturation values in a single application

SpO₂% threshold line
### Oximetry Statistics—On Screen

<table>
<thead>
<tr>
<th></th>
<th>S9 AutoSet</th>
<th>Serial No.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulse Rate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td>50</td>
<td>Median</td>
<td>63</td>
</tr>
<tr>
<td>Maximum</td>
<td>105</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ODI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ODI for the session</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SpO2 %</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SpO2 was less than</td>
<td>90</td>
<td>% for 00:00:02</td>
<td>hh:mm:ss</td>
</tr>
<tr>
<td>SpO2 was less than</td>
<td>80</td>
<td>% for 00:00:00</td>
<td>hh:mm:ss</td>
</tr>
<tr>
<td>SpO2 was less than</td>
<td>70</td>
<td>% for 00:00:00</td>
<td>hh:mm:ss</td>
</tr>
<tr>
<td>Minimum</td>
<td>89</td>
<td>Median</td>
<td>94</td>
</tr>
<tr>
<td>Maximum</td>
<td>99</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Using the S9 with an oximeter allows you to record the patient’s saturation and pulse rate for 30 nights.

Oxygen desaturation index (ODI): Represents the average number of desaturations per hour.

The desaturation percentage can be set by the user in the Options window in ResScan (default is 4%).

Note: Oximetry data is recorded while in therapy mode and when the patient is breathing into the mask.
The SpO₂ and Pulse Rate graphs are displayed alongside the other graphs (inspiratory flow limitation, events, pressure, flow, etc). This allows you to link the events to the level of desaturation.

In this example, the obstructive apneas cause a decrease in the SpO₂ and an increase in the pulse rate.

The device increases the pressure after the obstructive events (apnea and flow limitation).
Notes and Device Log

The **Device Log**, shown on the tool bar, is only used with the Stellar™ devices which support ventilation.

Add note here
Case Studies
Case Study 1: High leak–mouth leaks suspected

Patient treated on S9 AutoSet with a nasal mask. He is complaining of a dry mouth.

1. The average usage is excellent: 5 hours 49 min.

2. The level of unintentional leak is high:
   - 95th percentile leak > 24 L/min
   - median leak = 0 L/min.

3. The AHI is very high (32.4). There is also an unknown apnea index (4.1). This index is a further sign of high leak concurrent with apneas (leak > 30 L/min).

4. The treatment pressure at the 95th percentile is 19.8 cm H₂O with a maximum pressure setting of 19.9 cm H₂O.

In the presence of a high level of unintentional leak, the AHI value cannot be analyzed correctly. First, you need to solve the leak issue.

ResMed devices calculate unintentional leak:

Unintentional leak = Total leak − Intentional leak from mask CO₂ washout

You have to set the mask type (default is nasal).
Case Study 1:
Suggested Solution

Adding a humidifier can help to reduce nasal resistance and decrease mouth leak.

Replace the nasal mask with a ResMed full face mask if the leaks persist.

The AHI can be interpreted correctly when the leaks have been corrected.

A substantial improvement in the AHI can be expected, given the initially high unknown apnea index. The S9 doesn’t increase the pressure after this type of apnea. If these unknown apneas are actually obstructive apneas, they will be treated as such by the S9.

The summary data shows variable leak levels over the first few days, with a marked increase in leaks in the days following.

This detailed leak graph shows significant leak episodes in some periods and none at all in other periods.

Critical leak threshold
> 0.4 L/s or 24 L/min

The high level of leaks (> 24 L/min) and their characteristic plateau shape (steep rise, flattening off then returning to the base line) indicate the presence of significant and variable leaks, most likely mouth leaks.
Case Study 1: Example

Detailed data of the 14th of August Ultra Mirage™ nasal mask
Case Study 1: Example

Detailed data of the 18th of August ResMed full face mask
Case Study 2:
Low therapy usage—
Increase humidification or introduce ResMed ClimateLine™

The patient has recently been given an S9 AutoSet, but doesn’t use it very often. The patient also says that he feels very thirsty when he wakes up each morning.

The numbers 1–4 (below) show the recommended order in which the data should be analyzed.

1. The average usage was low (1 hrs 32 min).
2. The unintentional leaks are under control:
   - 95th percentile leak < 24 L/min
   - Median leak = 0.0L/min
3. The AHI is high, with a value of > 5.
4. The therapy pressure at the 95th percentile is 7.8 cm H₂O with a maximum pressure setting of 20 cm H₂O.

In light of the patient’s discomfort, a ResMed ClimateLine was added and the device settings were not changed.
Case Study 2:
Suggested Solution

Add a ClimateLine to make therapy more comfortable.

Result: Adding a ClimateLine led to a significant increase in compliance. The patient finds therapy more comfortable and has increased utilization.

The statistics obtained after the ClimateLine was introduced enabled the increase in compliance to be quantified (4 hours 26 min instead of 1 hrs 32 previously).
Case Study 3:
High AHI—suspected CSR

Patient treated on S9 AutoSet with a high AHI.

The numbers 1–4 (below) show the recommended order in which the data should be analyzed.

We can observe:

1. Good therapy compliance: Usage of 6 hours 50 min per day.
3. Leaks are under control (95th percentile leak: 9.6 L/min).
4. Pressure at the 95th percentile is 13.8 cm H₂O with a maximum pressure setting of 19.6 cm H₂O.

In this example, the patient’s consistently high AHI warrants concerns of efficacy and a look at the detailed data.
Case Study 3:
Suggested Solution

Perform a sleep study
to check for Cheyne–Stokes respiration (CSR).

Consider using an S9 VPAP Adapt
if CSR is confirmed.

Result: The sleep study confirmed the presence of CSR. The patient’s AHI normalized with the S9 VPAP Adapt.

To find out more, we have to look at the detailed data, and in particular the 7-day flow curve for each session.

During this night of treatment, we can observe:

• Numerous central apneas, particularly during the 2nd part of the night
• A flow curve pattern indicative of Cheyne–Stokes respiration

In ResScan, you can display the detailed curves side by side with two time scales, giving a better picture of how the patient is being treated. In this example:

• Pressure, unintentional leak, flow limitation and events graphs are displayed with a 2-hour time scale.
• The flow curve is displayed with a 5-minute time scale.
### Case Study 4: Noncompliant Patient

#### Review - S9 VPAP Auto, VAUTO

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<table>
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<th>S9 VPAP Auto</th>
<th>Serial No.</th>
<th>22102499692</th>
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#### Device Settings

- **Therapy Mode:** VAUTO
  - Min EPAP: 4.0 cmH2O
  - Max IPAP: 20.0 cmH2O
  - Pressure Support: 4.0 cmH2O

#### Usage

- **Total hours used:** 118:22
- **Median daily usage:** 6:42
- **Average daily usage:** 1:18

- **Used Days >= 4 hrs:** 18 days
- **Used Days < 4 hrs:** 0 days
- **Days not used:** 73 days
- **Total days:** 91 days

- **% Used Days >= 4 hrs:** 19%
Case Study 4: Noncompliant Patient

Summary Graphs

Trend shows poor usage pattern, high leak issues and high AI
### Case Study 5: Compliant Patient

**Review - Patient, Compliant**

| **Device Settings** | **Usage** | **AHI & AI**
|---------------------|-----------|-------------
| Therapy Mode: AutoSet | Total hours used: 159.36h | Average index: 2.2 |
| Minimum Pressure: 4.0 cmH2O | Used Days >= 4 hrs: 20 days | Obstructive: 1.9 |
| Maximum Pressure: 20.0 cmH2O | Used Days < 4 hrs: 1 day | Central: 0.2 |
| EPS Level: 2.0 cmH2O | Days not used: 1 day | Unknown: 0.0 |
| **Usage** | **AHI & AI**
| Total days: 30 days | **AHI:** 3.4 |
| Median daily usage: 7.02h/day of used days | **Occlusion Index:** 1.2 |
| **AHI & AI**
| **Leak Limit** | **Pressure cmH2O** |
| AHI & AI events/hour | Median: 0.0 | Median: 12.2 |
| Average index: 2.2 | 95th Percentile: 0.0 | 95th Percentile: 18.3 |
| Obstructive: 1.9 | Maximum: 2.4 | Maximum: 19.7 |
| Central: 0.2 | Unknown: 0.0 |
Case Study 5: Compliant Patient

Trend shows good usage, few leak issues and low AHI
Case Study 6: Compliant patient but having issues

Patient presently on VPAP III S mode, IPAP 24, EPEP 20. Patient struggling with therapy due to high pressure, leak issues and complaints of high respiratory rate. AHI is controlled but feels like breathing on the device is very hard work. However, patient is still wearing it almost 6 hours per night.
Case Study 7: Patient placed on S9 VPAP Adapt

Due to patient complaints, patient underwent several PSGs which revealed central apneas. Titrated on S9 VPAP Adapt, patient was sent home on it. Patient immediately felt a difference. He stated it was more comfortable and he could sleep more easily. Wore device longer (30 mins) and noticed decrease in pressure from 24/20 to Ipap of 14.8. Resp rate changed from 35 to 20.

This patient had been on the Vpap III for years. Always struggled but stuck with it. Complained that he could only tolerate the device for about 3-4 hours per session, then would have to take the mask off to “take a break.” Could not tolerate the high pressures.

In previous sleep studies he ended up on 25/20, and had many centrals in the lab study.

In his Adapt study, he went to sleep on the device with a Quattro™ FX within 20 mins. Slept soundly all night; had no centrals at all. After the EEP was increased to 8 cm, patient had no events or arousals. Got up wanting the device to be set up that day. He remarked he had not slept that well for a long time. Patient was set up a week later on the device.
Terminology & Definitions
Therapy Device Mechanics (S9)

Sensors in Therapy Device

- Measurement of pressure at the mask
- Measurement of flow

Enhanced AutoSet algorithm (central apnea detection)

Records:
- Flow-time curve
- Snore
- Apnea
Open unrestricted airway

Unrestricted inspiratory flow time curve

Pressure unchanged

Airway narrowing

Flattened inspiratory flow time curve denoting narrowed airway

Pressure increased based on degree of flattening. Flow limitation produces a fine adjustment.

Vibrating airway (snoring)

Snore superimposed on inspiratory flow time curve

Pressure increased based on snore. Louder snore produces faster rise.

Complete airway collapse

Absence of flow (>10sec) = apnea

Pressure increased at termination of apnea
CSA Detector—Forced Oscillation Technique

Respiratory Flow

10 seconds

4 seconds

6 seconds

Delay (expiratory pauses)

CSA detector begins

Apnea type detected (central or obstructive)
CSA Detector

CLOSED  If there is little or no flow, the airway is closed (obstructive)

OPEN  If there is flow, the airway is open (central)
CSA Detector—AutoSet Response

Enhanced AutoSet algorithm

Apnea (O) Apnea (C) Apnea (C) Apnea (O) Apnea (O) Apnea (C) Apnea (O) Apnea (O)
Three Lines of Defense

1. **Flow Limitation**
   - Derived from flow-time curve
   - Shape of the curve is key (rounded vs. flattened)
   - Device recognizes changes in the flow curve as flow limitation and will respond with changes in pressure

2. **Snore**
   - Derived from flow-time curve
   - Represented as “units of snore” (units of vibration)
   - Device increases pressure in response to snore

3. **Apnea**
   - Scored when there is a >75% reduction in airflow for more than 10 seconds
   - Increase pressure in response to length of obstructive apnea
   - No pressure response when a central apnea is detected

**Flow Limitation Diagram**
- Normal
- Partially Obstructed

**Snore Diagram**
- More vibration
- Little or no vibration

**Apnea Diagram**
- Showing no response to central apnea
**Glossary**

**Apnea**
The temporary absence or cessation of breathing. An apnea is scored when there is reduction in breathing by 75% of the baseline breathing for at least 10 seconds. ResScan shows three types of apneas:

- **Central Apnea**
  An apnea during which the upper airway remains open.

- **Obstructive Apnea**
  An apnea during which there is a physical closing of the upper airway.

- **Unknown Apnea**
  An apnea during which a leak higher than 30 L/min occurs, precluding accurate determination of whether the apnea is obstructive or central.

**Apnea Indices**
For all indices, the value shown for Statistics is the total number of events divided by the Daily Usage.

- **AI: Apnea Index**
- **HI: Hypopnea Index**
- **CAI: Central Apnea Index**
- **OAI: Obstructive Apnea Index**
- **UAI: Unknown Apnea Index**

**Average**
A calculated value of a set of numbers computed by adding the total number of values and dividing by the number of values. Average for usage (therapy) hours is calculated over total calendar days.

**Daily Usage**
Daily Usage is the total usage in a single session (a session starts at midday and finishes 24 hours later).

**Average Daily Usage**
Average daily usage is the result of the sum of Daily Usage divided by Used Days, over a selected time period.

**Median**
The middle number in a sorted list of numbers. Half the numbers in the list are less, and half the numbers are greater (Example: 3, 3, 4, 5, 5, 5, 6, 9, 12, 23, 48; median = 5). Median for usage (therapy) hours is calculated over days used.

**Median Daily Usage**
The middle value for daily usage, where values for Daily Usage are listed from low to high, over a selected time period. While a few exceptionally high or low values can have a significant influence on an average measure, the median is typically more reflective of the true central tendency.

**Event**
The occurrence of an apnea or a hypopnea. Events are recorded as they occur. The maximum number of events stored per session is 500. After 500th event, 501 replaces 500, 502 replaces 501, etc.

**Flow**
An estimate of the patient’s airflow during inspiration and expiration. It is derived by taking the total flow and removing the leak and mask vent flow components.

**Flow Limitation**
A measure of partial upper airway obstruction. This measure is based on the shape of the inspiratory flow–time curve. A flattening of the inspiratory flow–time curve suggests upper airway obstruction. A normal inspiratory curve would be round shaped.
Forced Oscillation Technique (FOT)
A technique that applies small oscillations in pressure (1 cm peak-to-peak) at 4Hz, and analyzes the pressure/flow response of this signal at the mask. FOT detects whether the airway is open or closed.

Hypopnea
An episode of shallow breathing during sleep. A hypopnea is scored when there is a reduction in breathing by 50% of baseline breathing associated with partial upper airway obstruction for at least 10 seconds.

Leak
An estimate of the total flow of air escaping due to mouth and mask leaks. It is derived by analyzing the inspiratory and expiratory airflows, together with the expected mask vent flows. High or changing leak rates may affect the accuracy of other measurements.

Minute Ventilation
The volume of air breathed in (or out) within any 60-second period.

95th Percentile
The 95th percentile says that 95% of the time, the variable (eg, pressure) is at or below this amount. Just the same, during the remaining 5% of the time, the variable is above that amount.

Pulse Rate
The number of heartbeats in a 60-second time frame. The pulse rate is calculated by an attached oximeter.

Snore Index
A measure based on the amplitude of the vibrations generated by a patient’s snoring.

SpO2
A measure of the saturation of blood hemoglobin with oxygen, expressed as a percentage. The oxygen saturation is calculated by an attached oximeter.

Therapy Pressure
In CPAP mode, therapy pressure is the set CPAP pressure. In AutoSet mode, therapy pressure is the pressure derived by the AutoSet algorithm.

Tidal Volume
The volume of air inspired or expired in one respiratory cycle (breath).

Total Hours Used
The total patient usage over a selected time range.

Usage
The length of time that a patient receives therapy from the device. The start and end times of the first ten individual periods of usage are available for each session when using ResScan.

Used Days
The total number of days during which daily usage exceeded the compliance threshold (X hours Y minutes).

% Used Days
Calculates the percentage of used days out of the total number of days selected.
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